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ABSTRACT

This two-section report presents a review of European research on the use of videotelephone technology by people with mental retardation. The first section examines relevant research concerning those with speech and language disabilities in general. Considered are visual communication including augmentative and alternative communication systems, remote communication (especially videotelephony), graphics-based remote communication (e.g., telefax), and picture communication. The second section looks at mental retardation and video telephony specifically. It reports on one Swedish study of three children and five adults with moderate mental retardation which found that four of the adults and two of the children increased their frequency of telephone use after being given training and access to a visual telephone system. This section also reports on a study carried out at a special school for mentally retarded children in Portugal which found that the children easily learned the use of the picture telephone and accepted its use. Also discussed are the use of videotelephones in education and health and care services, and the use of text telephony with persons with hearing impairments. The need for further research is stressed. (Contains 36 references.) (DB)

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VIDEOTELEPHONES AND MENTAL RETARDATION

Survey of Results Achieved and Research in Progress

June -92

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VIDEOTELEPHONES AND MENTAL RETARDATION

Survey of Results Achieved and Research in Progress

Jane Brodin and Magnus Magnusson

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Abstract

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The report presents the results of a survey of results and insights obtained and of research in progress on the use of videotelephone technology by people with mental retardation. The purpose is to give an overview of what has been achieved in the telecommunication area for this group of disabled people and to some extent also to summarize relevant knowledge gained in neighbouring fields. The present document reports only European research; in Report No. 2, forthcoming, the authors will present studies on this topic made in other parts of the world.

The systematic study of the use of telecommunication by people with some disability is a relatively young field and only limited investigations have as yet been made. Most of these refer to people with vision or hearing disabilities, and next to no attention has been given to mental retardation. However, studies made or underway in Sweden and Portugal indicate that videoteleophones may play an important role in supporting communication with and between people with mental retardation.

Keywords: videotelephony, mental retardation, communication, telecommunication, disability.

Abstract:

Brodin, Jane och Magnusson, Magnus (1992) *Bildtelefoni och Förståndshandikapp. En kunskaps- och forskningsöversikt.* Rapport nr 1 i serien Teknik, Kommunikation och Handikapp. Pedagogiska institutionen, Stockholms universitet.

Denna rapport är en kunskaps- och forskningsöversikt inom området bildtelefoni och förståndshandikapp. Syftet är att ge en uppfattning om vad som gjorts inom telekommunikationsområdet för denna handikappgrupp, men i viss utsträckning även belysa närliggande områden där befintlig kunskap kan användas för att komplettera bilden. I rapporten redovisas endast forskning från Europa. I rapport nr 2, som är under utarbetande (Brodin & Magnusson), kommer studier från andra delar av världen att presenteras.

Vi kan konstatera att telekommunikationsområdet är ett relativt ungt och oprövat forskningsområde och att endast begränsade studier gjorts. Flertalet studier har gjorts inom syn- och hörselskadeområdena, medan området förståndshandikapp inte uppmärksammats i nämnvärd utsträckning. Avslutade och pågående studier i Sverige och Portugal visar att bildtelefoni kan fylla en viktig funktion som stöd vid kommunikation för människor med förståndshandikapp.

Sökord: bildtelefoni, videotelefoni, förståndshandikapp, kommunikation, telekommunikation, handikapp

CONTENTS

	Page
Foreword	2
INTRODUCTION	4
Background	4
Purpose	6
Method	6
SPEECH AND LANGUAGE DISABILITY IN GENERAL	7
Visual communication	7
Remote communication	8
Graphics-based communication	9
Picture-based communication	10
MENTAL RETARDATION AND VIDEOTELEPHONY	11
Previous research	12
Videotelephony in education and health and care services	15
Text telephony and impaired hearing	17
DISCUSSION	18
REFERENCES	22

FOREWORD

People with mental retardation do not constitute a homogenous group. What they have in common is a reduced ability to receive and process information. It therefore takes longer for them to learn new things. The capability of abstraction is lower than normal and reality is perceived in a more concrete way. Abstract concepts are therefore harder to grasp. As a consequence, a mentally retarded person will meet difficulties in communicating with the environment. It has been shown that about 70 per cent of these people have speech and/or communication disorders. Many of them cannot use spoken language at all and depend entirely on other communciation channels. Others do use language but find picture information a great help as a complement to speech and writing in their daily intercourse with other people.

Generally speaking, people with mental retardation have been and still are a grossly neglected group. In all countries they have the lowest social status and are given the lowest priority by health and care administrations. As a consequence, they are also undersupplied with technical devices which could compensate for their disability.

Opinions also differ as to their need for support. They are sometimes said to have derived no satisfaction or benefit from technical devices. Such assertions, however, have no empirical basis and it is important to introduce a more realistic view on people with mental retardation, to increase the respect for their human value and to improve their opportunities for development. The need of the individual should decide and the goal of all agencies involved should be to compensate for and reduce the consequences of any functional impairment.

Pictures have proven to be a good help in communication for people with mental retardation, and today several graphical systems are used for communication. With the aid of pictures transferred over the telephone network, mentally retarded persons can use telephones. The improved communication capability is important not least to maintain social contacts.

The present report is a survey of results achieved so far and research in progress in this field. It was written by the authors in the start-up process of the European RACE 2033 project, "TeleCommunity", a three year's project with thirteen participants from nine countries. Within this RACE project, studies of telecommunications facilities for people with mental retardation will be carried out in three countries besides Sweden, viz.

Norway, Ireland and Portugal. The professional background of the Swedish team is experience in social and behavourial sciences, medicine and technology.

The experiences and opinions put forward in the report are those of the authors'.

Jan-Ingvar Lindström
Area manager
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INTRODUCTION

Background

Whenever new technolgoy is introduced, new terms are coined. One recent term is Integrated Services Digital Network, "ISDN", which is a telecommunication network accommodating all kinds of telecommunication services, such as telephony, telefax and picture and data transmission. In practice, this means that the user can use the same line for telephone conversations and telefax transmission of text and pictures. The fact that digital signals are transmitted over the network means that signal processing is more efficient and the transmission of large volumes of information therefore becomes faster.

ISDN has been criticized as unwanted technology for its own sake, "Innovation Subscribers Don't Need" (Andersson 1988, p 35). However, critics admit that these types of networks will fill an important need in the future. As shown in the picture below, an ISDN network will includes picture telephony, still picture transmission, Videotex, picture data bases and telefax services.

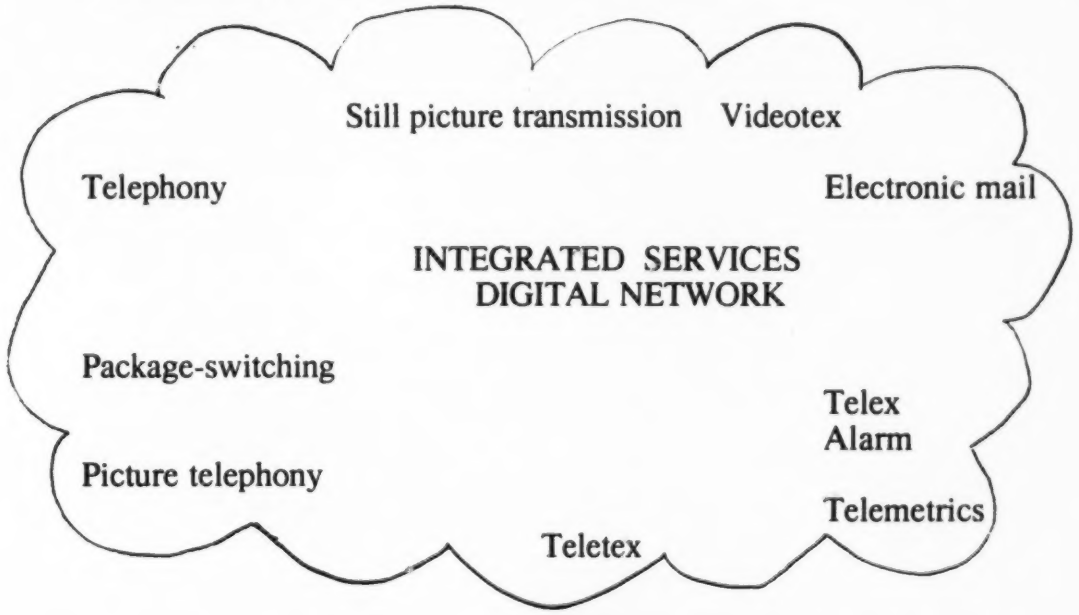

Fig. 1. Services integrated into an ISDN, according to Andersson 1988

An ISDN is typically a network with 2 x 64 kB/s capacity. Existing telephone lines have this capacity, and that is one important merit of the ISDN design: the lines connecting subscribers to the network are already there. However, this high capacity is nevertheless too low to transfer moving pictures. Motion must therefore be represented by means of some clever coding, which normally requires computing power in the user terminals.

An Integrated Broadband Communication Network, "IBCN", is a network with considerably higher capacity than ISDN. To a great extent it is based on the use of new high-capacity cables, particularly fiber optics cables. Networks of this type are being built and extended in many countries including Sweden. However, only some time after the year 2000 will they be in practical use among ordinary subscribers.

When introduced, these two kinds of networks will have a dramatic effect on the individual subscriber's life. Now, which of all technically feasible services will be offered is an economic question. The answer depends crucially on what people are willing to pay for. The increasing international cooperation is, however, likely to make demands on very efficient telecommunication facilities.

This development offers encouraging new possibilities for many disabled persons. However, the new equipment - and the instructions on how to use it - need to be adapted to the special conditions of disabled persons. Earlier studies of telecommunication for disabled persons (Andersson, 1988; Levin, 1989; Roos 1988), focussing primarily on those with impaired vision or hearing, have shown that the new technology, properly applied, offers possibilities for participation in social life on more equal terms and that difficulties can be avoided if the technology is adapted to human needs at the very start.

"Communication everybody-to-everybody" is the motto of Swedish Telecom. It is in the interest of Telecom that as many as possible take advantage of the new telecommunication facilities. One step in this direction is to provide remote access to the telephone registry. Today, the telephone catalogue consists of a number rather bulky books, which many disabled people find inconvenient to handle. Persons with impaired vision, motoric skills or intellectual capacity can use the telephone books as now designed ony with difficulty or not at all. For this purpose, Telecom offers a number retrieval service, which operates so that that somebody else helps in finding the desired subscriber number. In most European countries, this service is offered against a fee. The fee is heavily subsidized by the Swedish Telecom for persons with impaired reading ability. Today it is possible to make the number service much more cost-efficient by offering direct data base access over the telephone network. Swedish Telecom has established a data base access service, Videotext, which will probably be avialable commercially to a wide audience within a few years.

In an experiment including all groups of disabled persons, Brunér and Hampshire (1987) examined the possibilities of using the data base underlying the printed telephone books. The purpose was to investigate the function of the telephone book, how it is used now and how it can be made

more accessible to disabled people. The focus of the study was on people with vision and mobility diabilities. It appears from their report that they made interviews with representatives of The Swedish Federation of the Visually Impaired, The Association for the Motor Disabled, The Swedish Handicap Institute, and The Swedish Telecom. It is also said in the report that an electronic data base accessed via display terminals began to replace the printed telephone books as early as in 1979. The data base, which forms part of the Teletel system, is intended for the public. Enquiries are billed according to the time the user is connected to the search system. This arrangement makes the system expensive for people with motoric restraints who need more time for looking up a number. It has been discussed to store the telephone catalogue on CD-ROM (Compact Disc Read-Only Memory). If these discs are produced in large numbers, they would be a cheap solution, but there are ethical objections against storing individual-related information in a manner which can so easily be used for other purposes than those for which it was collected. In the United States and in Switzerland similar systems are being developed.

The conclusions drawn by Brunér and Hampshire is that the increased information, particularly the image information, stored in data bases create great problems for people with impaired vision. To eliminate these problems, cooperation between The Swedish Federation of the Visually Impaired and the organizations which provide health and care services is imperative. A well-motivated requirement may be, that data base information displayed on a screen should also always be available in auditory form, produced by speech synthesis.

For people with motoric disabilities, the problem is most often to adapt the equipment so that its operation becomes more convenient for them. On the whole, information in picture form tends to help people with motoric difficulties.

Purpose

The purpose of the present report is to give an overview of what has been achieved in the telecommunication area for this group of disabled people and to some extent also to summarize relevant knowledge gained in neighbouring fields.

Method

In addition to a study of the mentioned reports literature searches have been made in a number of bibliographical data bases, including ERIC, Pepsy, PsychLit, Medline, TUDOR and the Swedish library data base Libris. A few references were found to technological documents reporting

on video telephony but none on the combination of videotelephony and mental retardation. The field therefore still seems to be young and roads towards new result are open.

The report consists of two major parts:

- Speech and language disability in general
- Mental retardation and videotelephony.

The first part treats visual communication, remote communication, graphics-based remote communication and picture communication. The second treats videotelephony as used in education and health and care services, as well as text telephony.

SPEECH AND LANGUAGE DISABILITY IN GENERAL

Visual communication

During the last few decades, different methods have been developed for what is sometimes called Augmentative and Alternative Communication, "AAC", to aid people who for one reason or another are not capable of using normal speech. Three groups of disabled people are the major users of the new technology:

1. People with cognitive disability. These are people who have difficulties in mastering the conceptual structures underlying speech and writing. Their disability is sometimes characterized as secondary speech and language disability.

2. People with dysarthria, i.e., motoric difficulties to articulate speech sounds due to lesions in muscles or nerves.

3. People with aphasia, i.e., a primary language disability, due to lesions in the central nervous system.

People who belong to one of these groups sometimes use AAC where other people would use speech. Two of the most wellknown graphic symbols systems are Bliss and Pictogram. Together with some kind of icon tablets, where the intended message is pointed at, these are used by persons with serious dysarthria or mental retardation. These two systems differ in abstraction level. The Pictogram system builds on more concrete pictures and is therefore easier to grasp for mentally retarded persons. Bliss is a full picture-based language with an elaborate grammar, but the user must have a more advanced sense for abstraction.

Many persons with a language disability have more or less intact motoric skills (Magnusson 1991). They can then use sign language type of communication in many situations when speech does not function in a satisfactory manner. They are then independent of technical devices for communication and use their body to express themselves in an alternative communication system, in a manner similar to the way people with impaired hearing use sign language.

The groups mentioned all need a visual channel for communication. This is typically no problem when they communicate with persons face-to-face but when they want to communicate over a distance these people are doubly handicapped.

Until recently, vision-based communication over the telephone network in general was limited to text communication via computer terminals or video telephones, but today 90 per cent of the vision-based remote communication uses the telephone network.

Remote Communication

Speech and language disabilities cause problems in communication in general and remote communication in particular. By remote communication we shall mean communication where the participants cannot exchange signals without the aid of technical devices. Traditional devices for remote communication are pen and paper, megaphones, semaphores, looking-glasses, telegraphy equipment and in later years telephones, radio and television. Increasingly, remote communication is based on electronic telecommunication (Lindström 1989, Gorpe 1989). Telematics is an inclusive term for communication via some kind of network (Berti 1989). A network is a system for electronic communication via cable or radio. Wireless communication, as in a mobile telephone system, is usually based on radio. Videotelephony, text-based computer communication, and electronic mail are examples of new manners to utilize the telephone network (Andersson, 1988; Dopping, 1987; Cerveire 1988).

The new technology makes it possible to create situations which are perceived as very similar to face-to-face communication although the communicants are geographically remote from each other and interact via a network. We are approaching a state where what is felt as direct communication does not necessarily require physical proximity. This fact will no doubt deeply affect our use of language and our communication strategies. Expressions like "meet", "contact", "visit" can be expected to take on a new and generalized meaning. The word "direct" and possibly also "concrete" may also change in - So far, however, remote

communication has been predominantly speech or text based. Communication via telecommunication lines is relatively costly and information transfer via, e.g., CD-ROM (cf. p. 3 above) might be a better solution in some situations. Another manner of cutting connect time and thereby communication line cost is to use modems and software which transfer larger blocks of information over the telephone line at high speed, so that the user need be connected online to a central computer for only a short time.

Remote communication today is based on transmission of text, data, sound and images. The transmission is digital or analogous, i.e., by means of electrical pulses or by currents which vary continuously to represent, say, a speech signal. For technical reasons, digital transmission is often preferable. Therefore, practically all recently built telecommunication lines are based on digital signal transmission.

Particularly interesting is the possibility to transfer moving pictures over the telephone network. The methods used for this pupose - ISDN as well as IBCN - are almost entirely based on digital communication.

The terms used today for remote picture communication are picture telephony and videotelephony. We use the latter term for all forms of communication of moving pictures over high-capacity telecommunication lines, as a broader term including communication with moving pictures as well as picture telephony or communication with still pictures.

Fig. 2. Videotelephony

Graphics-based Remote Communication

Many methods are available today for graphics-based remote communication. Telefax is probably the most commonly used of these methods but it is not so interactive as some of the methods which recent picture telephone technology seems to offer. We do not know of any ongoing systematic evaluations of graphics-based remote communication systems for people with speech and language disability. An experiment with telefax communication for adults with moderate mental retardation, however, is being conducted. Six subjects are involved in the experiment (Brodin & Björck-Åkesson 1992a, forthcoming). Purely text-based

not here discuss the experiments which have been made with text telephony and computer conferences.

For Bliss users with severe dysarthria two evaluations have been made to test and develop telecommunication methods. In Canada, a method called Bliss-tel has been evaluated during one year of experimental use (Kennedy 1991). At about the same time an investigation was made of the requirements to be met by hardware and software for remote communication by means of symbols and pictures (Nilsson, Skjetne & Skjörten, 1991). In Norway, an experiment was made at the Norwegian Institute for Special Education and the Research Department of Norwegian Telecom to give support to people with aphasia using a graphical communication system called Telewriter. The system is based on the use of a stylus connected via a modem to the telephone line. When a user draws or writes with the pen, the outline is transferred to the other participant in the dialogue. At the same time, the users have auditive contact via the same line (Alstad & Bachman, 1991). The experiment showed that this method improves the contact between the therapist and his client and encourages the client to express himself graphically. Measurements also proved that the linguistic competence had increased significantly during the experiment period.

Picture Communication

A report from the Talking Newspaper Subsidy Committee Ds U 1986:6 shows that people with mental retardation can understand verbal information better if it is accompanied by pictures. The possibilities of receiving information therefore increase if the information is presented via double channels, by pictures and speech combined. Both still pictures and moving pictures can be used for this purpose. In December 1989, Swedish Telecom began marketing still picture telephones made by Panasonic. Dopping (1988) surveyed the potentialities of picture communication and analyzed the effects for disabled people. His report shows that the requirements differ between persons, not so much depending on the kind of disability as on the manner of communication. A person accustomed to a pictorial communication method such as Bliss or Pictogram can make good use of a still picture telephone whereas a person who relies on sign language in his daily life may need moving pictures. The need for moving pictures seems therefore to be established for people with severely impaired hearing, since sign language can be regarded as their native language. Dopping means that sign language editions of daily newspapers could be televisioned at night and video recorded at low marginal cost. This would be a new type of service to people with disabilities which would offer deaf people new opportunities to participate in the life of society.

For people with lost or impaired vision, reading stations have been set up which receive printed or handwritten messages and read them out via telephone to the user. However, this service implies that the user lets other persons read their private. This disadvantage should be balanced against the alternative arrangement that family members or neighbours are asked to read the letters, an arrangement which may be even more delicate. The tendency to present more and more information in pictorial form creates increasing problems for people with lost or impaired vision. There seem to be small problems to translate text mechanically into synthetic speech but there are no automatic procedures to present pictures auditively in an intelligible manner. For people with mental retardation a still picture telephone can support speech and make communication easier. This is confirmed in a study of still picture telephones for moderately mentally retarded persons (Brodin & Björck-Åkesson, 1991).

During this century a number of devices have been introduced to make the use of telephones easier, e.g., automatic dialling devices and loudspeaking telephones. A rather recent product which can be attached to a standard telephone is Panasonic Still Picture Telephone, WG-R2, which consists of a camera and a graphical display. If both parties to the conversation have such a telephone, it becomes possible to show a picture of the person who is talking or to transfer drawings, photos and Pictogram representations. The transfer of one picture takes about 6 seconds. The telephone also has a memory which can store the last few pictures transferred. This kind of telephone offers simultaneous auditive and visual information during a dialogue.

Retarded people generally have difficulties in using a telephone, for functional, social and cognitive reasons: he or she must be able to operate the telephone, have somebody to call, be able to carry out a conversation over telephone, be motivated to engage in a conversation and realize the benefits of making the effort to use the telephone.

Graphics-based communication systems are used today by many mentally retarded persons to enhance and develop their communicative competence. If given a visual telephone system, pictures can support speech and aid memory. Still picture telephony with concomitant auditive and visual information makes telephoning resemble normal face-to-face dialogue.

MENTAL RETARDATION AND VIDEO TELEPHONY

Brodin and Björck-Åkesson (1991) made an investigation aiming at finding out what use and pleasure moderately retarded persons could

derive in their daily life from using a still picture telephone. The study included children as well as adults.

Five adults and three children with moderate mental retardation were given access to a visual telephone system (Panasonic WG-R2) during five months. Two more mentally retarded persons, acting as telephone dialogue partners, were given the same facilities. The telephones were placed in the subjects' homes or day centers or in the homes of friends, relatives or temporary host families. Every person had at least one other picture telephone to call. A total of twenty picture telephones were used during the experiment.

Answers were sought to questions such as

* Can transmission of pictures over telephone lines make telephone communication easier?

* Can still picture telephones contribute to more and better social contacts and thus improve life quality?

* Can the still picture telephone be considered as a technical device appropriate for mentally retarded persons?

Central aspects of the study were the communicative competence of the mentally retarded subjects as well as the communicative form, the contents communicated and the purpose of communication. Data on each subject were collected by means of detailed enquiries on age, sex, family situation, housing conditions, social contacts, impaired functions and function evaluations, communication habits, available technical devices, ability to recognize and understand pictures and symbols, persons and voices, familiarity with telephones etc. For each subject a query form was filled out by day center staff in cooperation with family members and, for adults, the staff of the group homes. Every telephone dialogue was annotated by the person who helped the subject to make the call, diary entries were made at the end of each week, successive interviews were made with staff and parents during the project period and video recordings were made at the day centers. A total of 607 telephone dialogues were annotated. The annotations were computer processed.

The results of the study show that four of the adult users and two of the children increased their frequency of use of the telephone. They used the equipment more and more adequately and the picture helped them to communicate.

Important conditions for good performance are

- that the user feels a need to use the telephone in his or her daily life

- that the user takes the initiative to make telephone calls

- that the persons who help the user cooperate

- that the support from the environment is good

- that there are several persons to call

- that the user finds it relevant and natural to make telephone calls

- that the still picture equipment has been functionally adapted to the user

- that the equipment is continuously used.

The study shows that moderately retarded persons can have benefit and pleasure from a still picture telephone in their daily life. Six of the subjects are today using the telephone in a functional way and seem to have gained in independence and self confidence. The still picture telephone can be seen as a technical device appropriate for persons with moderate mental retardation.

Two subjects did not fullfil the experiment. One was the youngest subject, a girl of 6 1/2 years, whose mother claims that she is responsible for not carrying through the experiment because she was too tired to arrange systematic telephone training in the evening after long working days. The other was a 34-old woman who interrupted the experiment after only one month. She showed great anxiety and tenseness. The staff attributed this to her developmental disorder or impaired vision, but it is reasonable to believe that she did not get enough support for the task.

The small size of the group studied is, of course, a reason to be cautious in generalizing the results. Now, small samples are naturally frequent in studies on disabled persons, since disabled people consitute a minority of the population. On the other hand, a small sample permits in-depth examination of a specific situation. The strength of the study is that the subjects were described in great detail and that each was observed daily during five months.

Within the framework of RACE (Research and Development in Advanced Communication Technolgy in Europe), an EC project in the field of the study of disabled persons, the use of picture telephones by mentally retarded was studied at a special school for mentally retarded children in a rural area in Portugal (Pereira, Matos, Purificaçao & Lebre).

The purpose of the study was

- to investigate whether still picture telephones connected to a telephone network were easy to use by mentally retarded persons

- to observe how this group responded in a learning situation where the picture telephone was used

- investigate whether there was evidence of more regular participation in work/learning.

The study thus aimed at examining the usefulness of the telephone (cf. Brodin & Björck-Åkesson 1991).

One question posed in this project was whether children and young people who often stayed home from school could be made willing to participate in school work. One reason for their absence from school was assumed to be the long travelling distance (35-40 kilometers either way).

Fifteen subjects aged 8-23 participated. Eight of these were slightly, six moderately and one severely retarded. Twelve of the children had difficulties with vocabulary, twelve with articulation, six were stutterers and one had normal development of communication competence. The experiment was made with two picture telephones, installed in separate rooms in the school.

The report is based on structured interviews with staff and children and on observations of experiments. The children were divided into three groups, of six, eight and four children, respectively. Only one experiment was made with each of the subjects in each group.

The observations reported concerned

- breathing control
- body awareness and posture
- sense for numbers (sum and subtraction).

The study showed that the children very rapidly accepted the presence of the picture telephone. Sound and image quality were satisfactory and the children understood the teacher's questions without difficulty.The advantages of the picture telephones were considered to be considerable. Children who were often absent from school could be taught in their homes, which would be a great relief for those who lived far from the school. The picture telephone could also help engage the parents in their children's school work and increase their appreciation of the children's special needs.

One reason for making the study was to reduce the frequency of absence which was considered to be caused by the long travelling distances. Another reason for absence was not discussed in the report: the parents' attitude to what the school could offer the children. Probably the parents do not see the school as particularly important for the children, and it is therefore natural to let them stay home now and then. The long distances to school is a problem for many special school pupils in Sweden also. The possibility to teach the children at home is not uncontroversial, however. There is a risk that parents who do not recognize the value of school teaching let their children stay more and more at home. Children who have to resort to home teaching tend to be isolated and lack the social training they would get in a school with several different teachers and pupils.

The limitation of this study is that it is built on observations on only one occasion per child and that the two telephones where placed in rooms on the premises of the school. Research on children with development disturbances (e.g., Brodin, 1991; Granlund & Olsson, 1987) shows that their level of activity strongly depends on their physical condition and may vary from occasion to occasion to a significant degree. To record a behaviour characteristic of such a child, repeated observations are required. This aspect must be seen as very important.

An evaluation project concerning still picture telephones for severely retarded adult persons is being carried out during 1992 at Stockholm University with financial support from Swedish Telecom (Brodin & Björck-Åkesson, 1992b, forthcoming).

Videotelephones in education and health and care services

An evaluation of still picture telephones for persons with aphasia is being made during the period September 1991 to March 1992 (Magnusson 1992). The project is sponsored by Swedish Telecom and is carried out at the Aphasia Association. Preliminary results indicate that still picture telephony has greater value as a tool for communication between an aphasic person and his therapist than between two aphasics.

The possibilities to use picture telephony in teaching and instruction of staff examining children who need special support have been investigated by von Tetzchner, Hesselberg and Langeland (1991). Picture telephones were used to transfer information between a habilitation center (Bergs) for severely disabled children in Oslo and a local habilitation center in a small community (Valdres) outside Oslo. The purpose was to find new

ways for investigating these children and give advice during intervention. Both the technical performance of the equipment (a Tandberg 4001 64 kB/s picture telephone) and the system's user friendliness was investigated. The telephones were connected point-to-point in Oslo and Valdres. The equipment performed well during the project period. The users reported that they were satisfied with image quality. The reason for this conclusion may be that they compared picture telephoning with ordinary telephoning rather than with personal visits. But it can also mean that they really found that the picture gave a sufficient reinforcing effect. Image and sound were transmitted at different speed, over separate telephone lines. Sound and picture were therefore not synchronized.

The five children involved in the project were one to five years old. Four of them had been remitted to Berg for assessment. Physiotherapy had a central role in this project. The therapist at Valdres trained the child and her colleague at Berg looked at the picture and commented her activity. Every child participated on two to seven occasions.

The study shows that the need of routine checks can be reduced and the time between visits can be extended if pictured telephony is used between visits. The project also emphasized the importance of knowledge transfer following up the intervention. A comment from parents was that they would prefer picture telephony to routin checks at the Berg institute in Oslo, because that would eliminate the long and tiring trips to Oslo. One can also see this type of knowledge transfer as an important factor to promote equal rights and equal participation, since it helps to give everybody the same quality of intervention irrespective of where he lives. The limitation of the study is that only two videotelephones were available. An important conclusion is that picture telephones can be a valuable complement to ordinary examinations, reporting and telephone contacts.

Holand, von Tetzchner and Steindal (1991) report an experiment with picture telephones to train autistic children to use sign language. The children were three and five years old and lived in the North of Norway. The experiment was a part of the rehabilitation work. The purpose was to evaluate, functionally and technically, whether a 64 kB/s picture telephone could be used for sign language training. Via the picture telephone the two children and their parents and staff were trained. In all, 22 dialogues were carried out.

The image quality made it hard to see how the children performed the signs, so the teachers had to give verbal information on this. The major purpose, however, was to see how the training was arranged, what method was used, how the children were motivated, how much time was dedicated to the training and in what manner the teacher helped the child.

The picture telephone was also used for meetings. The image quality made it hard to see and react to weak turn-taking signals.

The result of this mini study shows that it is fully possible to use picture telephones for special training. The limitations discussed in this study are of a technical nature and refer to image quality. Clearly, no general conclusions can be drawn from the experiment, but it is reasonable to believe that for some children transmission of sign language messages would be a valuable complement to speech. More and more elderly people today prefer to live in their own appartments. The percentage of older people has increased because the average life time has increased and because the health of the population as a whole has improved. The lack of staff and hospital beds in health and care services is serious and therefore new needs arise for service to those who prefer to or have to live at home. Except that many elderly persons need practical care and help with household tasks, a need arises for security and supervision equipment. Not rarely, anxious relatives express this need. To solve this problem, videotelephones can be used.

A study of 32 persons aged 73-85, 26 of which had restricted mobility, showed that it was felt as a valuable security factor to be able to establish rapid contact with an alarm center (Perälä & Lounela 1991). For these people, a major requirement was to get service and social contact. Here also, technical supervision procedures pose questions of an ethical nature, since a central surveillor can check what a person is doing without being invited. Everything depends on how the technology is being used, and it is not self-evident that ethical aspects will be taken into considerations on all occasions. Another problem is that relatives may express demands which are hard to satisfy without intruding into the private life of an elderly, senile citizen. It is, however, a great advantage that the technology permits the old person to stay at home longer, and in these cases one has to balance the interests of all parties even though the situation is not unproblematic.

Text telephony and impaired hearing

Persons with severely impaired or totally lost hearing can use an ordinary text telephone. For persons who cannot read or write the current language of the country, the video telephone has an important function (Dopping 1991).

Most experiments with picture-based interactive remote communication for disabled people have been made with persons with loss of hearing. Adult persons, who are deaf since childhood, have communicated via videotelephones in several countries. A coordinated multinational experiment was carried out in the framework of the European pilot project Application Pilot for People with Special Needs ("APPSN") which

is a project within the RACE project to develop new applications of broadband technology in Europe. One such experiment was made with a link between Västanvik and Stockholm (Delvert, 1989; Dopping, 1990).

The British partners to APPSN have concentrated on defining the technical specifications for videotelephony for elderly people (Wilson, Welbank & Ussher, 1990; Welbank, Ussher & Wilson, 1990). British Telecom has made several experiments with different forms of videotelephony. Different technical solutions have been tested and compared to face-to-face communication. In all cases, a satisfactory interaction was observed between the participants. The varying levels of technical quality did not seriously reduce the intelligibility of the messages.

Studies performed at the Heinrich Hertz Institute for Information Technology in Berlin, in contrast with the research reported above, indicate that readability of sign language messages greatly depends on how much of the other person one can see in the picture and that higher image quality therefore is required (Blom & Mühlback, 1990).

The relevance of screen design to readability appears also from a study at the Institute for Numerical Analysis and Computer Science ("NADA") at the Royal Institute of Technology in Stockholm. The study is primarily oriented towards labour ergonomy but is of interest to everyone interested in communication via graphic displays (Smedshammar, Frenckner, Nordqvist & Romberger 1990). Studies have also been made of the influence of the picture on understanding and recollection in remote communication between elderly persons and the staff helping or serving them (Garwood, 1991).

The Swedish Telecom has been engaged during the last few years in development projects concerning videotelephony not only for disabled persons but also concerning ergonomy in general in connection with videotelephony. In several studies, the effects of the screen size, illumination and camera position have been investigated. The result common to these investigations is that added visual information increases the tolerance towards loss of auditive information during a dialogue and that supplementary visual information has the same effect on intelligibility as increased volume during a traditional telephone conversation.

DISCUSSION

In the present report we have given an account of research and development projects which have been made or are being made in the field of videotelephony, in order to survey the prospects of the use of videotelephony by people with mental retardation, as a base for further

videotelephony by people with mental retardation, as a base for further studies in the framework of the project TeleCommunity. To illustrate new methods for communication via the telephone network we have mentioned projects for people with mental retardation as well as such projects in neighbouring fields which we have meant to be indicative of videotelephony in general. Picture-based remote communication is a form for communication which so far has not been often used and tested by any group of disabled persons. An exception is a small number of experiments with transmission of sign language messages for persons with loss of hearing.

When one talks about picture-based remote communication, one refers primarily to picture telephony. Telefax is so far primarily seen as a tool for text communication. Picture telephony, which we prefer to call videotelephony, appears in two main forms: still picture telephony and moving picture telephony. The experience shows that communication with transmisson of moving pictures comes closer to face-to-face communication and is perceived as a more natural kind of interaction.

The most important characteristics of normal face-to-face communication are

- that one can see the dialogue partner

- that one can follow body motion and mouth movements at the same time as one hears speech

- that speech signals can be reinforced by gestures

- that the speaker gets immediate feedback on the signals he emits.

A decisive difference between still pictures and moving pictures is therefore that still pictures are used as a support for certain signals whereas moving pictures are seen as a medium or a support through which all signals pass so that this medium permits natural interaction. Some researchers emphasize the importance of image quality for the efficiency of interaction (e.g., von Tetzchner 1990) whereas others do not note any significant differences in intelligibility or perceived interaction which could be attributed to different image transmission quality. There are also researchers who claim that ergonomic aspects of image quality and background illumination are of great importance for the perception of pictures (e.g., Lo, 1990).

The studies mentioned treated communication between persons with serious loss of hearing for whom visual reading of mouth movements and signs are crucial. The demands on image quality seem to be greater for those who have loss of hearing and have to read the dialogue partner's

gestures and mimics from the screen than for those who use the picture as a supplement to speech. This is shown, i.a., by experiments with mentally retarded persons (e.g., Brodin & Björk-Åkesson, 1991; Pereira, Matos, Purificacao & Lebre, 1991). In other words, the conditions for this group seem to be different and their demands on technical quality seem to be lower. This result may be due to the fact that people with mental retardation normally are undersupplied with technical devices and are happy to be given some attention at all. But it can also be due to the fact that the picture gives them so much more information that the communication is in fact essentially improved. During all the experiments made, the user were obliged to adapt themselves to the equipment and its given limitations. However, a few adaptions to the special needs of the users had been made in the form of loudspeaking telephones, automatic dialling devices and more convenient controls.

When studying the potentialities of video communication for different groups of disabled people it is therefore necessary to make a proper analysis not only of the amount of interaction but also of the quality of interaction with regard to how the interaction is perceived by the user. How natural and "close" one feels the interaction to be varies from person to person and from situation to situation. A similar conclusion will probably also be reached if one studies initiative and response to communication.

It is also important to analyse the contents communicated and verify whether messages really reach the recipients. It seems to be a pedagogic question whether videotelephones can be used for knowledge transfer or not.

The conclusions which can be drawn from the studies mentioned is that the efforts made so far have focussed on transmission of moving pictures for persons with loss of hearing and for elderly persons. The studies show that these groups can benefit greatly as regards communication if they are offered videotelephony.

Earlier studies (e.g., Brodin & Björck-Åkesson, 1991) have shown that still picture telephones are an adequate technical device for mentally retarded persons provided that the equipment and the environment are properly adapted. In this study we found that though the screen in the equipment used did not have the quality desired the telephones functioned reasonably well and did constitute a communicative support. The possibilities of transferring moving pictures probably makes telecommunication even more attractive for a mentally retarded person. One should expect that this technology opens exciting possibilities for persons who lack the capacity of speech and who therefore have to resort to sign communication; they will be a new group of users.

were used in an teaching situation. The result confirms the belief that videotelephony is appropriate as a support in remote teaching and thus provides important help to families who live far away from schools and training centers.

One limitation of our account for the research and development work in the area studied is that we have so far based the study entirely on European research. Probably, there are also relevant studies in the United States, though most likely not studies directly oriented towards the mentally retarded. We draw the latter conclusion from the fact that at an international conference in Washington D.C. in December 1991 on Technology and Disability only one paper discussed mental retardation and videotelephony and that was a paper presented by Leonor Pereira from Portugal (cf. above). This lack of interest may be explained by the fact that this group of disabled persons probably is given low priority in countries which are oriented towards performance and results. It is therefore reasonable to assume that people with mental retardation is relatively neglected also in this respect.

The Swedish Telecom har previously sponsored projects oriented towards videotelephony for people with loss of hearing, and in the project RACE 2033, TeleCommunity (the Swedish social and behavioural science component of which is hosted by the Department of Education, Stockholm University), Swedish Telecom will finance studies of videotelephony for disabled persons. The technical component of the project is lead by Sven-Håkan Nilsson, Daltek AB. The three-year project started on January 1, 1992, with financial support from Swedish Telecom and aims primarily at a survey of the prospects of telecommunication for disabled persons. The project is mainly oriented towards an investigation of how videotelephony can encourage people with mental retardation to communicate and thus participate in society. Videotelephony should be a natural constituent of daily life, as telephones are for other citizens. The Swedish study, therefore, is more oriented towards research where communicative competence is in focus.

During the latter half of 1992 a pilot study will be made. It is a limited experiment to obtain knowledge and experience of how equipment can be used and adapted to make the work more convenient later. Nine countries participate in RACE 2033. TeleCommunity. In the part related to people with mental retardation Portugal, Ireland, Norway and Sweden participate. Several reports will be published on the Swedish part (Brodin & Magnusson, 1992b) and the international part of the project

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